KCET PYQ 2023

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CHEMISTRY

Q1 A pair of compounds having the same boiling points are **[KCET 2023]**

(A) cis but-2-ene and trans but-2-ene
(B) n-hexane and neo-hexane
(C) benzene and naphthalene
(D) (+) butan-2-ol and (-) butan-2-ol

Q2 Identify A, B and C in the sequence.

$$CH_3CH_2Br \xrightarrow[Alc.]{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow{HNO_2} C$$

[KCET 2023]

(A) $CH_3\ CH_2\ CN, CH_3\ CH_2\ CH_2\ NH_2, CH_3\ CH_2\ CH_2\ OH$
(B) $CH_3\ CH_2\ NC, CH_3\ CH_2\ OH, CH_3\ CH_2\ CH_2\ NH_2$
(C) $CH_3\ CH_2\ CN, C_2H_5\ OH, C_2H_5N_2\ Cl$
(D) $CH_3\ CH_2\ CN, CH_3\ CH_2\ NH_2, C_2H_5\ OH$

Q3 $CH_3 - CH = CH - CH_2\ OH \xrightarrow{PCC} CH_3 - CH = CH - CHO$

Hybridisation change involved at C-1 in the above reaction. **[KCET 2023]**

(A) sp^3 to sp
(B) sp^3 to sp
(C) sp^3 to sp^2
(D) sp to sp^2

Q4 If a didentate ligand ethane-1, 2-diamine is progressively added in the molar ratio en : Ni :: 1: 1, 2 : 1, 3 : 1 to $[Ni(H_2O)_6]^{2+}$ aq solution, following co-ordination entities are formed.

I. $[Ni\,(H_2O)_4\ en]^{2+}(aq)$ – paleblue

II. $[Ni\,(H_2O)_2(en)_2]^{2+}(aq)$ – blue / purple

III. $[Ni\,(en)_3]^{2+}(aq)$ – violet

The wavelength in nm of light absorbed in case of I and III are respectively **[KCET 2023]**

(A) 475 nm and 310 nm
(B) 300 nm and 475 nm
(C) 310 nm and 500 nm
(D) 600 nm and 535 nm

Q5 Which of the following is an organometallic compound **[KCET 2023]**

(A) $CH_3\ COONa$ (B) $CH_3\ CH_2\ MgBr$
(C) $(CH_3\ COO)_2\ Ca$ (D) $CH_3\ ONa$

Q6 A better reagent to oxidise primary alcohols into aldehyde is **[KCET 2023]**

(A) PCC
(B) Alkaline $KMnO_4$
(C) Acidified $K_2Cr_2O_7$
(D) CrO_3

Q7 In the reaction,

$$C_6H_5CN \xrightarrow[(ii)\ H_3O^+]{(i)\ SnCl_2+HCl} X \xrightarrow{conc.\ KOH} Y + Z$$

Formation of X, Y and Z are known by **[KCET 2023]**

(A) Rosenmund reduction, Cannizzaro reaction
(B) Clemmensen reduction, Sandmeyer reaction
(C) Wolff-Kishner reaction, Wurtz reaction
(D) Stephen reaction, Canizzaro reaction

Q8 Compounds P and R in the following reaction are $CH_3CHO \xrightarrow[(ii)\ H_3O^+]{(i)\ CH_3MgBr} P \xrightarrow[Heat]{conc.\ H_2SO_4} Q \xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ B_2H_6} R$

[KCET 2023]

(A) Position isomers
(B) Functional isomers
(C) Metamers
(D) Identical

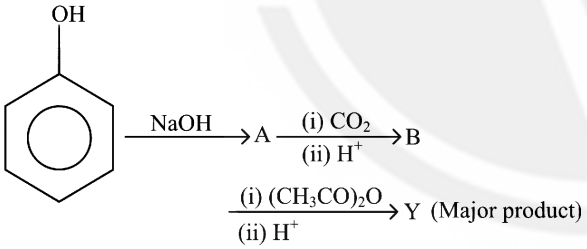
Q9 Aniline does not undergo **[KCET 2023]**

(A) nitration
(B) sulphonation
(C) Friedel-Craft's-reaction
(D) bromination

Q10 The heating of phenyl methyl ether with HI produces an aromatic compound A which on treatment with conc. HNO_3 gives B. A and B respectively are **[KCET 2023]**

(A) methanol, ethanoic acid
(B) picric acid, phenol
(C) iodobenzene, 1-iodo-4-nitrobenzene
(D) phenol, picric acid

Q11



Y in the above reaction is **[KCET 2023]**

(A) salicylaldehyde
(B) aspirin
(C) cumene
(D) picric acid

Q12 Sucrose is dextrorotatory but after hydrolysis the mixture show laevorotation, this is because of **[KCET 2023]**

(A) laevorotation of glucose is more than dextrorotation of fructose.
(B) sucrose is a non-reducing sugar.
(C) racemic mixture is formed.
(D) laevorotation of fructose is more than dextrorotation of glucose.

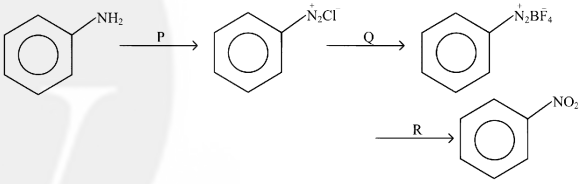
Q13 The correct order of match between column X and column Y is

	X		Y
I.	Vitamin A	I.	Muscular weakness
II.	Vitamin D	II.	Increased blood clotting time
III.	Vitamin E	III.	Night-blindness
IV.	Vitamin K	IV.	Osteomalacia

[KCET 2023]

(A) I-iv, II-iii, III-ii, IV-i
(B) I-ii, II-i, III-iii, IV-iv
(C) I-iii, II-ii, III-iv, IV-i
(D) I-iii, II-iv, III-i, IV-ii

Q14 In the reaction,



P, Q and R respectively are **[KCET 2023]**

(A) $NaNO_2 +$ dil. $HCl, HBF_4, Cu + NaNO_2$
(B) $NaNO_2 +$ conc. $HCl, F_2, Cu + NaNO_3$
(C) $NaNO_2 +$ dil. $HCl, BF_3, Cu + NaNO_2$
(D) $NaNO_2 +$ dil. $HCl, F_2, Cu + NaNO_3$

Q15 Thyroxine produced in the thyroid gland is an iodinated derivative of **[KCET 2023]**

(A) threonine (B) lysine
(C) tyrosine (D) tryptophan

Q16 Which one of the following is a non-narcotic analgesic? **[KCET 2023]**

(A) Heroin (B) Codeine
(C) Aspirin (D) Morphine

Q17 Receptors are proteins and crucial to body communication process. These receptors are embedded in **[KCET 2023]**

(A) cell membrane
(B) protein
(C) endocrine gland
(D) chromosomes

Q18 Which of the following monomers form biodegradable polymers ? **[KCET 2023]**

(A) Ethylene glycol and phthalic acid
(B) Caprolactum and 1, 3-butadiene
(C) Phenol and formaldehyde
(D) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid

Q19 Match the List-I with List - I in the following.

	List-I		List-II
1.	Caprolactum	a.	$-\left(CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}\right)_n-$
2.	Vinyl chloride	b.	$-\left(CH_2-\underset{\displaystyle C_6H_5}{\underset{\vert}{CH}}\right)_n-$
3.	Styrene	c.	$-\left(CH_2-\underset{\displaystyle Cl}{\underset{\vert}{CH}}\right)_n-$
4.	Propene	d.	$-\left(\overset{\displaystyle O}{\overset{\Vert}{C}}-(CH_2)_5-\underset{\displaystyle H}{\underset{\vert}{N}}\right)_n-$

[KCET 2023]

(A) 1-c, 2-d, 3-a, 4-b
(B) 1-a, 2-d, 3-c, 4-b
(C) 1-d, 2-c, 3-a, 4-b
(D) 1-d, 2-c, 3-b, 4-a

Q20 The correct order of first ionisation enthalpy of given elements is **[KCET 2023]**

(A) Li < B < Be < C
(B) Be < Li < B < C
(C) C < B < Be < Li
(D) Li < Be < B < C

Q21 Which of the following statement is incorrect ? **[KCET 2023]**

(A) $\text{Bond length of } O_2 > \text{Bond length of } O_2^{2+}$
(B) $\text{Bond order of } O_2^{+} < \text{Bond order of } O_2^{2-}$
(C) $\text{Bond length of } O_2 > \text{Bond length of } O_2^{2-}$
(D) $\text{Bond order of } O_2 > \text{Bond order of } O_2^{2-}$

Q22 A gas at a pressure of 2 atm is heated from 25°C to 323°C and simultaneously compressed of $\frac{2}{3}$rd of its original value. Then the final pressure is **[KCET 2023]**

(A) 1.33 atm (B) 6 atm
(C) 2 atm (D) 4 atm

Q23 Lattice enthalpy for $NaCl$ is $+788\ kJ\ mol^{-1}$ and $\Delta H^{\circ}_{hyd} = -784\ kJ\ mol^{-1}$.
Enthalpy of solution of NaCl is **[KCET 2023]**

(A) $+572\ kJ\ mol^{-1}$
(B) $+4\ kJ\ mol^{-1}$
(C) $-572\ kJ\ mol^{-1}$
(D) $-4\ kJ\ mol^{-1}$

Q24 At 500 K, for a reversible reaction $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ in a closed container, $K_C = 2 \times 10^{-5}$.. In the presence of catalyst, the equilibrium is attaining 10 times faster. The equilibrium constant K_C in the presence of catalyst at the same temperature is **[KCET 2023]**

(A) 2×10^{-4}
(B) 2×10^{-6}
(C) 2×10^{-10}
(D) 2×10^{-5}

Q25 A weak acid with pK_a 5.9 and weak base with pK_b 5.8 are mixed in equal proportions. pH of the resulting solution is **[KCET 2023]**

(A) 7.005 (B) 7.5
(C) 7 (D) 7.05

Q26 Temperature of 25°C in Fahrenheit and Kelvin scale respectively are **[KCET 2023]**

(A) $77^{\circ}F \text{ and } 298.15\ K$
(B) $17^{\circ}F \text{ and } 298.15\ K$
(C) $45^{\circ}F \text{ and } 260.15\ K$
(D) $47^{\circ}F \text{ and } 312.15\ K$

Q27 The number of protons, neutrons and electrons in the ion $^{32}_{16}S^{2-}$ respectively are **[KCET 2023]**

(A) 16, 18, 16 (B) 16, 16, 18

(C) 18, 16, 16 (D) 16, 16, 16

Q28 A pair of amphoteric oxides is **[KCET 2023]**

(A) Al_2O_3, Li_2O (B) BeO, BO_3

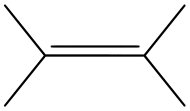
(C) BeO, MgO (D) BeO, ZnO

Q29 The composition of water gas is **[KCET 2023]**

(A) $CO(g) + N_2(g)$ (B) $CH_4(g)$

(C) $CO(g) + H_2O(g)$ (D) $CO(g) + H_2(g)$

Q30 IUPAC name of the compound is



[KCET 2023]

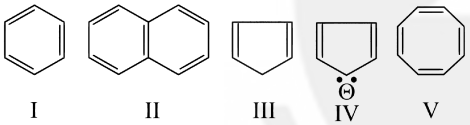
(A) 2, 3-dimethylbut-2-ene

(B) 2, 3-dimethyl butyne

(C) 1, 1, 2, 2-tetra methyl ethene

(D) 2, 3-dimethyl butene

Q31 Among the following.



I II III IV V

The set which represents aromatic species is **[KCET 2023]**

(A) I, II and III (B) III, IV and V

(C) II and III (D) I, II and IV

Q32 Which one of the following gases converts haemoglobin into carboxy haemoglobin? **[KCET 2023]**

(A) CO (B) O_2

(C) NO (D) CO_2

Q33 What is the oxidation number of S in $H_2S_2O_8$? **[KCET 2023]**

(A) +5 (B) +4

(C) +7 (D) +6

Q34 A 30% solution of hydrogen peroxide is **[KCET 2023]**

(A) '30 volume' hydrogen peroxide

(B) '10 volume' hydrogen peroxide

(C) '50 volume' hydrogen peroxide

(D) '100 volume' hydrogen peroxide

Q35 If 'a' stands for the edge length of the cubic systems. The ratio of radii in simple cubic, body centred cubic and face centred cubic unit cells is **[KCET 2023]**

(A) $1a : \sqrt{3}a : \sqrt{2}a$ (B) $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

(C) $\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{2}}{2}a$ (D) $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$

Q36 Dimerisation of solute molecules in low dielectric constant solvent is due to **[KCET 2023]**

(A) hydrogen bond

(B) covaelent bond

(C) co-ordinate bond

(D) ionic bond

Q37 The swelling in feet and ankles of an aged person due to sitting continuously for long hours during travel, is reduced by soaking the feet in warm salt water. This is because of **[KCET 2023]**

(A) reverse osmosis

(B) osmosis

(C) edema

(D) diffusion

Q38 A sample of water is found to contain $5.85\%\left(\frac{w}{w}\right)$ of AB (molecular mass 58.5) and $9.50\%\left(\frac{w}{w}\right)XY_2$ (molecular mass 95). Assuming 80% ionisation of AB and 60% ionisation of XY_2, the freezing point of water sample is [Given, K_f for water 1.86 K kg mol^{-1}, Freezing point of pure water is 273 K and A, B and Y are monovalent ions.] **[KCET 2023]**

(A) 264.25 K (B) 265.56 K

(C) 280.44 K (D) 281.75 K

Q39 Match the column A (type of crystalline solid) with the column B (example for each type)

	A		B
P.	Molecular solid	I.	SiC
Q.	Ionic solid	II.	Mg
R.	Metallic solid	III.	H_2O
S.	Network solid	IV.	MgO

[KCET 2023]

(A) P - iii, Q - i, R - ii, S - iv

(B) P - iv, Q - iii, R - ii, S - i

(C) P - ii, Q - iv, R - iii, S - i

(D) P - iii, Q - iv, R - ii, S - i

Q40 A metal crystallises in a body centred cubic lattice with the metallic radius $\sqrt{3}A$. The volume of the unit cell in m^3 is **[KCET 2023]**

(A) 64×10^{-29}

(B) 4×10^{-29}

(C) 6.4×10^{-29}

(D) 4×10^{-10}

Q41 The resistance of 0.1 M weak acid HA in a conductivity cell is 2×10^3 Ohm. The cell constant of the cell is 0.78 C m^{-1} and λ°_m of acid HA is 390 S cm^2 mol^{-1}. The pH of the solution is **[KCET 2023]**

(A) 3.3 (B) 4.2

(C) 5 (D) 3

Q42 In which one of the following reactions, rate constant has the unit mol L^{-1} s^{-1} ? **[KCET 2023]**

(A) Acid catalysed hydrolysis of CH_3COOCH_3

(B) $CHCl_3 + Cl_2 \rightarrow CCl_4 + HCl$

(C) $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

(D) Decomposition of HI on the surface of gold

Q43 For a reaction, the value of rate constant at 300 K is 6.0×10^5 s^{-1}. The value of Arrhenius factor A at infinitely high temperature is **[KCET 2023]**

(A) $6 \times 10^5 \times e^{-E_a/300R}$

(B) $e^{-E_a/300R}$

(C) $\frac{6 \times 10^{-5}}{300}$

(D) 6×10^5

Q44 The rate constant k_1 and k_2 for two different reactions are $10^{16} \times e^{-2000/T}$ and $10^{15} \times e^{-1000/T}$ respectively. The temperature at which $k_1 = k_2$ is **[KCET 2023]**

(A) $\frac{2000}{2.303}K$

(B) 2000 K

(C) $\frac{1000}{2.303}K$

(D) 1000 K

Q45 During the electrolysis of brine, by using inert electrodes, **[KCET 2023]**

(A) O_2 liberates at anode

(B) H_2 liberates at anode

(C) Na deposits on cathode

(D) Cl_2 liberates at anode

Q46 Consider the following 4 electrodes

$A : Ag^+(0.0001M)/Ag(s);$

$B : Ag^+(0.1M)/Ag(s);$

$C : Ag^+(0.01M)/Ag(s);$

$D : Ag^+(0.001M)/Ag(s); E^{\circ}_{Ag^+/Ag} = +0.80\ V$

Then reduction potential in volts of the electrodes in the order. **[KCET 2023]**

(A) B > C > D > A

(B) C > D > A > B

(C) A > D > C > B

(D) A > B > C > D

Q47 When $FeCl_3$ is added to excess of hot water gives a sol 'X'. When $FeCl_3$ is added to NaOH(aq) solution, gives sol 'Y'
X and Y formed in the above processes respectively are **[KCET 2023]**
(A) $Fe_2O_3 \cdot xH_2O/OH^-$ and $Fe_2O_3 \cdot xH_2O/Fe^{3+}$
(B) $Fe_2O_3 \cdot xH_2O/H^+$ and $Fe_2O_3 \cdot xH_2O/Na^+$
(C) $Fe_2O_3 \cdot xH_2O/Cl^-$ and $Fe_2O_3 \cdot xH_2O/OH^-$
(D) $Fe_2O_3 \cdot xH_2O/Fe^{3+}$ and $Fe_2O_3 \cdot xH_2O/OH^-$

Q48 The reducing agent in the given equations

$$4Ag(s) + 8CN^-(aq) + 2H_2O(aq) + O_2(g) \rightarrow 4[Ag(CN)_2]^-(aq) + 4OH^-(aq)$$

$$2[Ag(CN)_2]^-(aq) + Zn(s) \rightarrow [Zn(CN)_4]^{2-}(aq) + 2Ag(s)$$

[KCET 2023]
(A) Zn (B) O_2
(C) H_2O (D) CN^-

Q49 For the formation of which compound in Ellingham diagram $\Delta G°$ becomes more and more negative with increase in temperature ? **[KCET 2023]**
(A) CO (B) FeO
(C) ZnO (D) Cu_2O

Q50 Which of the following compound does not give dinitrogen on heating? **[KCET 2023]**
(A) $Ba(N_3)_2$ (B) NH_4NO_2
(C) NH_4NO_3 (D) $(NH_4)_2Cr_2O_7$

Q51 Aqueous solution of raw sugar when passed over beds of animal charcoal, it becomes colourless. Pick the correct set of terminologies that can be used for the above example. **[KCET 2023]**

(A)

Adsorbent	Adsorbate	Process
Solution of sugar	Animal charcoal	Sorption

(B)

Adsorbent	Adsorbate	Process
Animal charcoal	Solution of sugar	Absorption

(C)

Adsorbent	Adsorbate	Process
Animal charcoal	Colouring substance	Adsorption

(D)

Adsorbent	Adsorbate	Process
Colouring substance	Animal charcoal	Adsorption

Q52 For Freundlich adsorption isotherm, a graph of $\log(x/m)_{vs}\ \log(p)$ gives a straight line. The slope of line and its Y-axis intercept respectively are **[KCET 2023]**
(A) $\log\left(\frac{1}{n}\right)k$ (B) $\frac{1}{n}, \log k$
(C) $\log\left(\frac{1}{n}\right), \log k$ (D) $\frac{1}{n}, k$

Q53 In solid state, PCl_5 is a/an **[KCET 2023]**
(A) octahedral structure
(B) ionic solid with $[PCl_6]^+$ and $[PCl_4]$
(C) ionic solid with $[PCl_4]^+$ and $[PCl_6]$
(D) covalent solid present in the form of P_2Cl_{10}

Q54 In which one of the following pairs, both the elements does not have $(n-1)d^{10}ns^2$ configuration in its elementary state ? **[KCET 2023]**
(A) Zn, Cd (B) Cd, Hg
(C) Hg, Cn (D) Cu, Zn

Q55 Which of the following is correct with respect to melting point of a transition element ? **[KCET 2023]**

(A) V > Cr (B) Cr > Mn

(C) Mn > Fe (D) Ti > V

Q56 $aMnO_4^- + b\ S_2O_3^{2-} + H_2O \rightarrow xMnO_2 + ySO_4^{2-} + zOH^-$ a and y respectively are **[KCET 2023]**

(A) 8;3 (B) 8;6

(C) 3;6 (D) 8;8

Q57 Which formula and name combination is incorrect? **[KCET 2023]**

(A) $K_3[Al(C_2O_4)_3]$ – Potassium trioxalatoaluminate(III)

(B) $[Pt(NH_3)_2Cl(NO_2)]$ – Diamminechloridonitrito – N – platinum(II)

(C) $[CoCl_2(en)_2]Cl$ – Dichloridodiethylenediammine cobalt(III) chloride

(D) $[Co(NH_3)_4(H_2O)Cl]Cl_2$ – Tetraammineaquachloridocobalt(III) chloride

Q58 Which of the following system in an octahedral complex has maximum unpaired electrons ? **[KCET 2023]**

(A) d^9 (high spin) (B) d^6 low spin)

(C) d^4 (low spin) (D) d^7 (high spin

Q59 The correct decreasing order of basicity of hydrides of group- 15 elements is **[KCET 2023]**

(A) $SbH_3 > AsH_3 > PH_3 > NH_3$

(B) $PH_3 > AsH_3 > SbH_3 > NH_3$

(C) $AsH_3 > SbH_3 > NH_3 > PH_3$

(D) $NH_3 > PH_3 > AsH_3 > SbH_3$

Q60 Which one of the following oxoacids of phosphorus can reduce $AgNO_3$ to metallic silver ? **[KCET 2023]**

(A) H_3PO_2 (B) $H_4P_2O_7$

(C) H_3PO_3 (D) H_3PO_4

Answer Key

Q1	D
Q2	A
Q3	C
Q4	D
Q5	B
Q6	A
Q7	D
Q8	A
Q9	C
Q10	D
Q11	B
Q12	D
Q13	D
Q14	A
Q15	C
Q16	C
Q17	A
Q18	D
Q19	D
Q20	A
Q21	B
Q22	B
Q23	B
Q24	D
Q25	D
Q26	A
Q27	B
Q28	D
Q29	D
Q30	A
Q31	D
Q32	A
Q33	D
Q34	D
Q35	B
Q36	A
Q37	B
Q38	A
Q39	D
Q40	A
Q41	D
Q42	D
Q43	D
Q44	C
Q45	D
Q46	A
Q47	D
Q48	A
Q49	A
Q50	C
Q51	C
Q52	B
Q53	C
Q54	D
Q55	B
Q56	B
Q57	C
Q58	D
Q59	D
Q60	A

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

The correct answer to the question: "A pair of compounds having the same boiling points are," is Option D: (+)butan-2-ol and (-)butan-2-ol.

Option A: cis but-2-ene and trans but-2-ene have different spatial arrangements around the double bond. This difference in geometry leads to different physical properties, especially boiling points. Typically, the trans isomers are less polar and have a lower boiling point compared to the cis isomers.

Option B: n-hexane and neo-hexane (more correctly called 2,2-dimethylbutane) are structural isomers, which means they have different structures and thus different intermolecular forces and boiling points. n-hexane is a straight-chain alkane, whereas neo-hexane is a highly branched alkane. The increased branching in neo-hexane decreases the surface area for intermolecular interactions, leading to a lower boiling point than n-hexane.

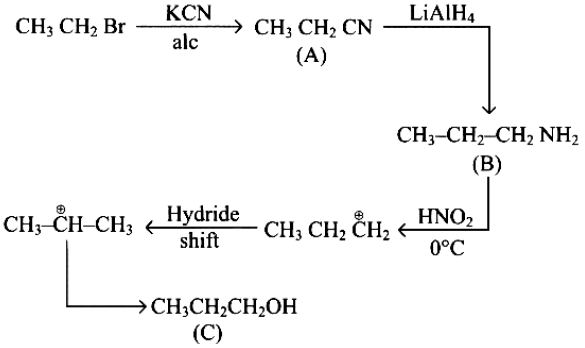
Option C: Benzene and naphthalene are aromatic hydrocarbons, but they are not isomeric. Benzene has a single aromatic ring, while naphthalene has two fused aromatic rings. This difference results in naphthalene having a significantly higher boiling point than benzene due to the larger surface area and greater London dispersion forces in naphthalene.

Option D: (+)butan-2-ol and (-)butan-2-ol are enantiomers, which are stereoisomers that are non-superposable mirror images of each other. Enantiomers have identical physical properties (e.g., boiling point, melting point) in a non-chiral environment because they share the same molecular formula and connectivities. The (+) and (-) refer to the different optical activities of the molecules; that is, they rotate plane-polarized light in different directions, but this does not affect the boiling point of the compound.

Therefore, the only pair of compounds listed with the exact same boiling point would be the R and S enantiomers of butan-2-ol (also known as (+) and (-) butan-2-ol), as noted in Option D.

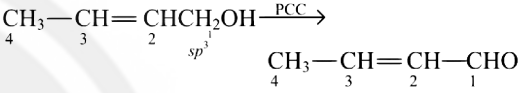
Q2 Text Solution:

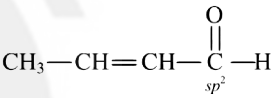
The given sequence of reaction is as follows



Q3 Text Solution:

For the given reaction hybridisation change is as follows



or 

Thus, hybridisation of C-1 changes from sp^3 to sp^2.

Q4 Text Solution:

Given that, compound I shows pale blue colour. It means that, absorbed colour is orange whereas compound III shows violet colour then the absorbed colour is yellow. The wavelength of light absorbed by I and III are nearly 600 nm and 535 nm respectively.

Q5 Text Solution:

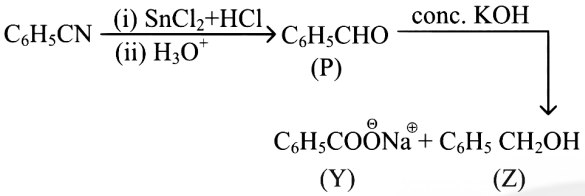
CH_3CH_2MgBr is considered as an organometallic compound because it contains a direct bond between a carbon atom and a metal atom (magnesium). Organometallic compounds contains at least one carbon-metal bond.

Q6 Text Solution:

PCC (pyridinium chlorochromate) is a commonly used reagent for the oxidation of primary alcohols to aldehyde. It is favoured due to its selectivity, mild reaction conditions, compatibility with functional groups and ease of handling.

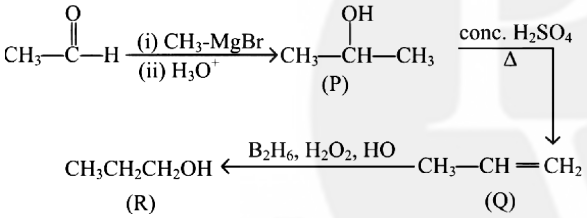
Q7 Text Solution:

The given reaction can be completed as follows.



Formation of 'X' involves Stephen reaction whereas the later part involves Cannizzaro reaction.

Q8 Text Solution:

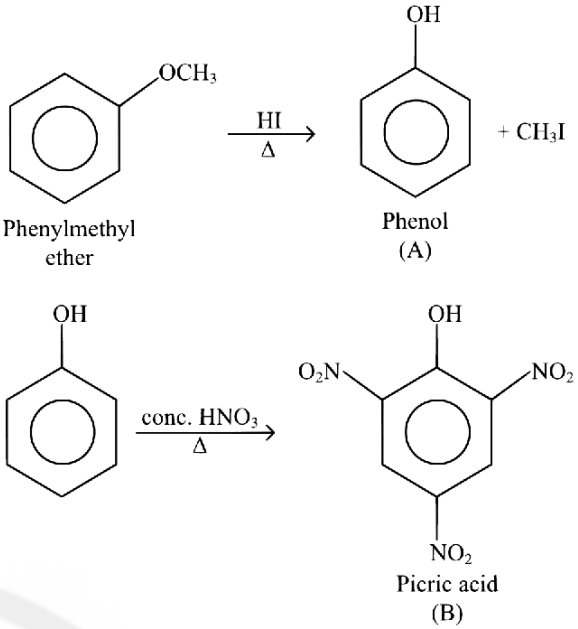


Since, the position of functional group varies in compound P and R. Thus, P and R are positional isomers.

Q9 Text Solution:

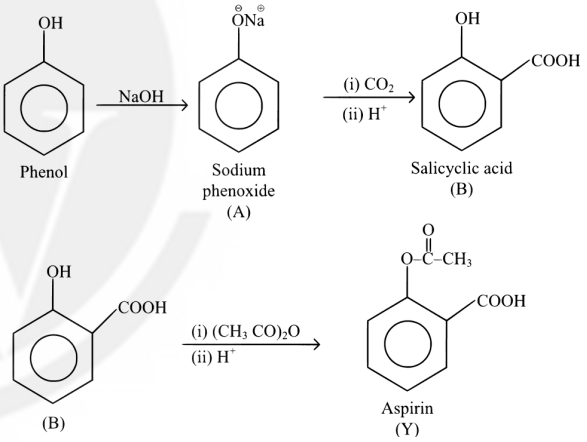
Aniline does not undergoes Friedel-Craft's reaction due to the presence of an amino ($-NH_2$) group attached to the aromatic ring. This amino group makes the aromatic ring highly nucleophilic and deactivates the ring towards electrophilic attack due to the electron donating nature of the lone pair on nitrogen.

Q10 Text Solution:



Thus, the compound (A) and (B) are phenol and picric acid respectively.

Q11 Text Solution:



Thus, the compound Y in above reaction is aspirin.

Q12 Text Solution:

Sucrose exhibits laevorotation upon hydrolysis due to the specific arrangement of its constituent molecules. When sucrose is hydrolysed, it undergoes a chemical reaction that breaks the glycosidic bond, resulting in the formation of glucose and fructose as individual monosaccharides.

Since the rotation of glucose is opposite in sign to that of fructose, their combined effect leads to the observed laevorotation i.e. (laevorotation of fructose is more than dextrorotation of glucose.)

Q13 Text Solution:

The correct match is I-iii, II-iv, III-i, IV-ii.

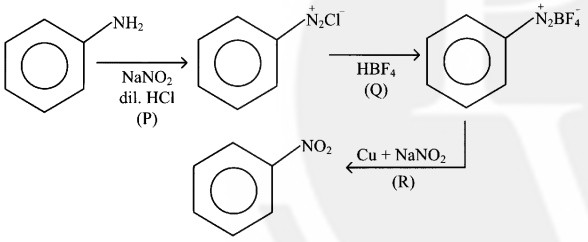
I. Vitamin A - (iii) Night blindness

II. Vitamin D - (iv) Osteomalacia

III. Vitamin E - (i) Muscular weakness

IV. Vitamin K - (ii) Blood clotting time

Q14 Text Solution:



Thus P, Q and R are $NaNO_2 + dil\ HCl, HBF_4, Cu + NaNO_2$ respectively.

Q15 Text Solution:

Thyroxine, also known as tetraiodothyronine or T_4 is an iodinated derivative of the amino acid tyrosine. It is a hormone produce by the thyroid gland and plays a crucial role in regulating the metabolism and growth in the body.

Q16 Text Solution:

Among the options provided, **Option C: Aspirin** is the correct one that is classified as a non-narcotic analgesic. Let's look at each substance listed to understand why Aspirin is the non-narcotic analgesic among them:

Heroin (Option A) is an opioid, like morphine, and it is a narcotic analgesic. It's known for its high potential for addiction and abuse, and it's not used medically in many countries.

Codeine (Option B) is also an opioid and is considered to be a narcotic analgesic. It is used for its analgesic, antitussive (cough suppressant), and antidiarrheal properties. It has a lower potential for addiction than heroin but is still classified as a narcotic.

Aspirin (Option C) is the only non-narcotic analgesic listed here. Aspirin belongs to a class of drugs known as nonsteroidal anti-inflammatory drugs (NSAIDs). It works by inhibiting the production of prostaglandins, substances in the body that play a role in pain and inflammation. Aspirin is used not only for pain relief but also for its anti-inflammatory and antipyretic (fever-reducing) effects. It can also be used for its antiplatelet effects, which can reduce the risk of a stroke or heart attack.

Morphine (Option D) is a potent opioid analgesic drug that is used to treat severe pain. It is definitely classified as a narcotic, and like heroin, it also has a high potential for addiction and abuse.

Therefore, Aspirin falls under the category of non-narcotic analgesics, primarily because it does not bind to opioid receptors, does not produce euphoria or significant addiction risk when used appropriately, and is widely used as an over-the-counter medication for various pain and inflammatory conditions.

Q17 Text Solution:

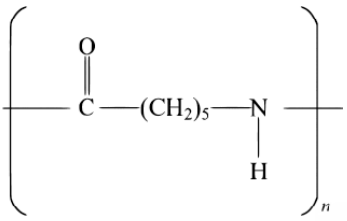
Receptors are embedded in cell membranes or located intracellularly within cells.

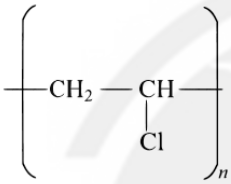
Q18 Text Solution:

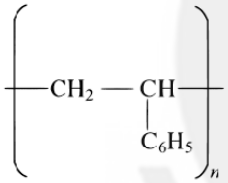
PHBV is a biodegradable polymer that belongs to the family of polyhydroxyalkanoates (PHAs). It is composed of two monomeric units i.e. 3-hydroxybutanoic acid and 3-hydroxypentanoic acid.

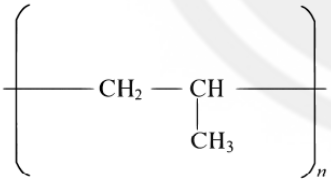
Q19 Text Solution:

The correct match is 1-d, 2-c, 3-b, 4-a.

1. Caprolactum 

2. Vinyl chloride 

3. Styrene 

4. Propene 

Q20 Text Solution:

Ionisation enthalpy of elements generally increases on going from left to right along a period.

But Be nane half-filled electronic configuration which requires more energy to ionise as compare to B. Thus, the correct order will be Li < B < Be < C.

Q21 Text Solution:

Compound	Bond order
O_2	2
O_2^+	2.5
O_2^{2+}	3
O_2^-	1.5
O_2^{2-}	1

We know that,

$$\text{Thus, bond order} = O_2^{2+} > O_2^+ > O_2 > O_2^- > O_2^{2-}$$

$$\text{Bond length} \propto \frac{1}{\text{Bond order}}$$

$$\therefore \text{Bond length} = O_2^{2+} < O_2^+ < O_2 < O_2^- < O_2^{2-}$$

Thus,

the incorrect statement is given in option (b) i.e. bonds order of O_2^+ < bond order of O_2^{2-}.

Q22 Text Solution:

Given, $p_1 = 2$ atm

$p_2 = ?$

$V_1 = 1$ L

$V_2 = \frac{3}{2}$

$T_1 = 298$ K

$T_2 = 596$ K

Using combined gas law, we get $\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$

$$\Rightarrow p_2 = \frac{2\times1}{298} \times \frac{3\times596}{2} = 6 \text{ atm}$$

Q23 Text Solution:

$$\Delta H_{sol} = \Delta H_{lattice} + \Delta H_{hydration}$$

$$= 788 + (-784) = 4 \text{ kJ mol}^{-1}$$

Q24 Text Solution:

The value of the K_C remains same as catalyst does not affects the K_C. Only temperature can alter the value of the K_C of a given reaction. Thus, the equilibrium constant K_C in the presence of catalyst at the same temperature is 2×10^{-5}.

Q25 Text Solution:

pH of the resultant solution is given by,

$$pH = 7 + \frac{1}{2}(pK_a - pK_b) = 7 + \frac{1}{2}(5.9 - 5.8)$$

$$pH = 7.05$$

Q26 Text Solution:

$$F = \frac{9}{5}^{\circ}C + 32$$

$$= \frac{9}{5}(25) + 32 = 77^{\circ}F$$

$$= 273.15 +^{\circ} C = 273.15 + 25 = 298.15 K$$

Q27 Text Solution:

To find the number of protons, neutrons, and electrons in the sulfur ion $^{32}_{16}S^{2-}$, we can analyze the given atomic symbol:

The atomic number (lower subscript) corresponds to the number of protons. In this notation, the atomic number is 16, so sulfur has 16 protons.

The mass number (upper superscript) is the sum of protons and neutrons in the nucleus. Here, the mass number is 32. Since we already know there are 16 protons, we can find the number of neutrons by subtracting the number of protons from the mass number:

Number of neutrons = Mass number – Number of protons

Number of neutrons = 32 – 16

Number of neutrons = 16

Lastly, the superscript 2– indicates the ion has a charge of –2, which means there are two more electrons than protons in the ion (since electrons are negatively charged and each additional electron adds a negative charge). To find the number of electrons:

Number of electrons = Number of protons + 2

Number of electrons = 16 + 2

Number of electrons = 18

Thus, the number of protons, neutrons, and electrons in the $^{32}_{16}S^{2-}$ ion are:

Protons: 16

Neutrons: 16

Electrons: 18

This corresponds to:

Option B 16, 16, 18

Q28 Text Solution:

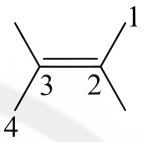
BeO, Al_2O_3 and ZnO are amphoteric in nature MgO and Li_2O are basic in nature whereas BO_3 is acidic. Thus, the pair of amphoteric oxides are BeO and ZnO.

Q29 Text Solution:

Water gas is primarily composed of carbon monoxide and hydrogen gas i.e CO(g) + H_2(g).

It is a valuable industrial feedstock and used in production of chemicals, fuels and as a reducing agent in metallurgical applications.

Q30 Text Solution:



The IUPAC name of the compounds is 2, 3-dimethylbut-2-ene.

Q31 Text Solution:

Compounds I, II and IV have continuous delocalisation of π-electrons and have (4n + 2π) electrons.

On the other hand compound III does not shows conjugation and compound V has 4nπ electrons. Thus, compounds given in only I, II and IV are aromatic.

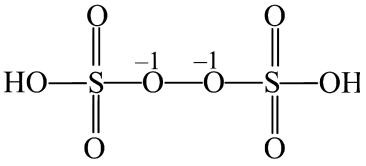
Q32 Text Solution:

Carbon monoxide (CO) converts haemoglobin to carboxyhaemoglobin. When CO is inhaled, it binds with haemoglobin in red blood cells with a much higher affinity compared to oxygen.

This binding forms carboxyhaemoglobin which prevents the normal binding of oxygen to haemoglobin, leading to a decreased oxygen-carrying capacity of the blood.

Q33 Text Solution:

The structure of $H_2S_2O_8$ is as follows



Let the oxidation state of sulphur be x. Then,

$2x + 2 + 2(-1) + 6(-2) = 0$

$\therefore x = +6$

Thus, the oxidation state of S in $H_2S_2O_8$ is $+6$.

Q34 Text Solution:

30% (w/v) H_2O_2 means that 30 grams of H_2O_2 is present in 100 mL of the solution

$\Rightarrow$It is equal to '100 V' H_2O_2.

Q35 Text Solution:

For simple cube,

$r = \frac{a}{2}$

For bcc, $r = \frac{a\sqrt{3}}{4}$

For fcc, $r = \frac{a}{2\sqrt{2}}$

where, a = edge length, r = radius

Thus,

ratio of radii of the three unit cells will be $\frac{\sqrt{3}}{2}a$: $\frac{\sqrt{3}}{4}a$: $\frac{1}{2\sqrt{2}}a$

Q36 Text Solution:

Dimerisation of solute molecules in low dielectric constant solvent is primarily due to intermolecular interactions such as van der Waals' forces and hydrogen bonding. These forces allow the solute molecules to overcome the electrostatic repulsion and form stable dimers.

Q37 Text Solution:

Soaking feet in warm water promotes the osmosis of molectles, including fluids, by increasing their kinetic energy. It also facilitates the movement of molecules from an area of higher concentration (swollen tissues) to an area of lower concentration (the bloodstream). This helps in reducing swelling by removing excess fluid and promoting proper circulation.

Q38 Text Solution:

AB

5.85%

$m = \frac{5.85}{58.5} \times \frac{1000}{84.65}$

$= 1.181$

XY_2

9.5%

$m = \frac{9.5}{95} \times \frac{1000}{84.65}$

$= 1.181$

$\alpha = 0.8$ (for 80% ionisation)

$\alpha = 0.6$ (for 60% ionisation)

$i = 1 + (2-1)0.8$ $\quad i = 1 + (3-1)0.6$

$= 1.8$ $\quad = 2.2$

Now $\Delta T_f = K_f[i_1 m_1 + i_2 m_2]$

$= 1.86[1.8(1.181) + 2.2(1.181)]$

$= 1.86[4.72] = 8.78$

$\therefore T_f = 264.25$ K

Q39 Text Solution:

To match the type of crystalline solid (column A) with the correct example (column B), we'll need to understand what characterizes each type of solid:

- **Molecular solids** are composed of molecules held together by intermolecular forces, such as London dispersion forces, dipole-dipole interactions, or hydrogen bonds.
- **Ionic solids** are formed by the electrostatic attraction between oppositely charged ions.
- **Metallic solids** consist of closely packed metal atoms arranged in a lattice where the outer electrons are delocalized over the entire solid, giving rise to metallic bonding.
- **Network solids** (also known as covalent network solids) are made up of atoms connected by covalent bonds in a continuous network extending throughout the material.

Let's identify each given substance:

- **SiC (Silicon Carbide)** is a network solid. Atoms of silicon and carbon are bonded together through strong covalent bonds,

forming a rigid three-dimensional structure.

- **Mg (Magnesium)** is a metallic solid. It consists of magnesium atoms in a metallic lattice with delocalized valence electrons.
- **H_2O (Water, in solid form as ice)** is a molecular solid. The water molecules are held together by hydrogen bonds, which are a type of intermolecular force.
- **MgO (Magnesium Oxide)** is an ionic solid. It is composed of Mg^{2+} and O^{2-} ions held together by strong electrostatic forces.

Based on this information, we can now correctly match column A with column B:

- **P. Molecular solid** should be matched with **iii. H_2O** (since water ice is a molecular solid).
- **Q. Ionic solid** should be matched with **iv. MgO** (because it's composed of ions held together by ionic bonds).
- **R. Metallic solid** should be matched with **ii. Mg** (as magnesium is a metal with a metallic bond structure).
- **S. Network solid** should be matched with **i. SiC** (because silicon carbide has a network structure with covalent bonds).

The correct match is:

- P - iii
- Q - iv
- R - ii
- S - i

This combination is provided in **Option D**.

Q40 Text Solution:

$$r = \sqrt{3}\text{Å} = \sqrt{3} \times 10^{-10} \text{ m}$$

$$\text{For bcc, } r = \frac{\sqrt{3}a}{4}$$

$$a = \frac{4r}{\sqrt{3}} = \frac{4 \times \sqrt{3} \times 10^{-10}}{\sqrt{3}} = 4 \times 10^{-10}$$

$$a^3 = 64 \times 10^{-30} = 6.4 \times 10^{-29} \text{ m}^3$$

Thus, the volume of the unit cellis 6 $.4 \times 10^{-29}$ m^3.

Q41 Text Solution:

$$\text{Given, } C = 0.1 \text{ M}$$

$$\Lambda_m^\circ = 390 \text{ S cm}^2 \text{ mol}^{-1}$$

$$R = 2 \times 10^3 \text{ ohm}$$

$$G^* = 0.78 \text{ cm}^{-1}$$

Now,

$$K = \frac{R}{G^\star} = \frac{0.78}{2 \times 10^3} = 3.9 \times 10^{-4}$$

$$\Lambda_m^\circ = \frac{K \times 1000}{C} = \frac{3.9 \times 10^{-4} \times 1000}{0.1} = 3.9$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{3.9}{390} = 10^{-2}$$

$$[H^+] = C \cdot \alpha = 0.1 \times 10^{-2} = 10^{-3}$$

$$\text{So, } pH = -\log 10^{-3} = 3$$

Q42 Text Solution:

The given unit of the rate constant i.e. mole L^{-1} s^{-1} suggests that the reaction is of zero order. So, among the given options, decomposition of HI on the surface of gold is a zero order reaction.

Q43 Text Solution:

$$\text{Given, } k = 6 \times 10^5 \text{ s}^{-1}$$

Using the formula of Arrhenius equation,

$$k = e^{E_a/RT}$$

$$\text{At } T = \alpha, \frac{-E_a}{RT} \text{ will become zero,}$$

$$\text{So, } k = Ae^0 \Rightarrow k = A$$

$$\text{Thus, } k = A = 6 \times 10^5$$

Q44 Text Solution:

$$K_1 = 10^{16} \times e^{-\frac{2000}{T}}$$

$$K_2 = 10^{15} \times e^{-\frac{1000}{T}}$$

$$\text{Now, } K_1 = K_2$$

$$10^{16} \times e^{\frac{-2000}{T}} = 10^{15} \times e^{\frac{-1000}{T}}$$

$$10 = e^{\frac{1000}{T}}$$

Taking ln on both sides,

$$\ln 10 = \frac{1000}{T} \ln e$$

$$2.303 \log 10 = \frac{1000}{T} \Rightarrow T = \frac{1000}{2.303} \text{ K}$$

Q45 Text Solution:

During electrolysis of brine using inert electrodes.

$$\text{Atanode} : 2\,Cl^- \rightarrow Cl_2 + 2e^-$$

$$\text{Atcathode} : 2H_2O + 2e^- \rightarrow H_2 + 2\,OH^-$$

$$\text{Overall, } 2NaCl + 2H_2O \rightarrow Cl_2 + H_2 + 2\,NaOH$$

i.e. Cl_2 is produced at anode while H_2 is produced at cathode.

Q46 Text Solution:

$$E_{Ag^+/Ag} = E^\circ_{Ag^+/Ag^\circ} + \frac{0.059}{n}\log[Ag^+]$$

According to this equation, as concentration of metal ion increases, reduction potential of metal electrode also increases i.e E $\propto$ concentration.

$$\therefore B > C > D > A$$

Q47 Text Solution:

When $FeCl_3$ is added to an excess of hot water, it hydrolyses to form a sol 'X' containing $Fe_2O_3 \cdot xH_2O$ and Fe^{3+} ions.

$$FeCl_2 + H_2O \rightarrow Fe_2O_3 \cdot xH_2O/Fe^{3+} + 2\,Cl^-$$

When $FeCl_3$ is added to NaOH(aq) solution, a precipitation reaction occurs. The Fe^{3+} ions from $FeCl_3$ react with OH^- ions from NaOH to form brown precipitate of $Fe(OH)_3$. This brown precipitate forms a sol 'Y' containing $Fe_2O_3 \cdot xH_2O$ and OH^- ions.

$$FeCl_3 + 3NaOH \rightarrow Fe_2O_3 \cdot xH_2O/OH^- + 3\,NaCl$$

Q48 Text Solution:

Zn acts as a reducing agent in the given reactions. It reduces Ag and itself gets oxidised.

Q49 Text Solution:

Understanding Ellingham Diagrams

- Ellingham diagrams depict the relationship between the standard Gibbs free energy change of formation (ΔG°) and temperature (T) for various metal oxides.
- A more negative ΔG° signifies a more thermodynamically favorable reaction, implying greater stability of the oxide.
- The slope of a line on an Ellingham diagram is related to the standard entropy change (ΔS°) of the reaction:
- **Negative slope:** ΔS° is negative (less gas produced than consumed)
- **Positive slope:** ΔS° is positive (more gas produced than consumed)

Finding the Answer

The formation of carbon monoxide (CO) exhibits a unique behavior on the Ellingham diagram:

- **Negative Slope:** The reaction has a negative slope, indicating a negative ΔS° : $2C(s) + O_2(g) \rightarrow 2CO(g)$
- **Increasing Stability:** As temperature increases, the ΔG° for the formation of CO becomes increasingly negative. This means CO becomes more stable at higher temperatures.

Other Options:

The formation of FeO, ZnO, and Cu_2O have positive slopes on the Ellingham diagram, indicating that their stability decreases as temperature increases.

Correct Answer

- **Option A: CO**

Q50 Text Solution:

Among the given compounds, only ammonium nitrate does not produces N_2 gas on decomposition.

$$Ba(N_3)_2 \xrightarrow{\Delta} Ba + 3\,N_2$$

$$NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$$

$$NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$$

$$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$$

Q51 Text Solution:

Animal charcoal-Adsorbent

It adsorbs and provide numerous sites for adsorption.

Colouring substance - Adsorbate

Colouring substance attract and binds the animal charcoal on its surface and acts as absorbate.

This process is known as adsorption. In this process molecules or particles adhere to the surface of the adsorbent through physical or chemical interactions.

Q52 Text Solution:

We know that, Freundich adsorption isotherm equation is given by

$$\log \frac{x}{m} = \log k + \frac{1}{n}\log p \ldots . (i)$$

$$\text{Also equation of straight line is } y = mx + c \ldots (ii)$$

$$\text{On comparing Eq. (i) and Eq. (ii), we get Slope, } m = \frac{1}{n}$$

$$\text{Intercept, } c = \log k$$

Q53 Text Solution:

PCl_5 is an ionic solid composed of $[PCl_4]^+$ ions and $[PCl_6]^-$ ions. In an ionic solid, there is a transfer of electrons between atoms, resulting in the formation these cations and anions. These opposite charged ions held together by electrostatic forces forming a crystal lattice structure.

Q54 Text Solution:

Among the given elements copper and does not have $(n-1)d^{10}ns^2$ configuration while zinc have this configuration in its elementary state.

Thus in option (d) both the elements don't have $(n-1)d^{10}ns^2$ configuration

$$Cu \rightarrow 4s^1 3d^{10}$$

$$Zn \rightarrow 4s^2 3d^{10}$$

Q55 Text Solution:

In general, the melting points of transition elements increases across a period from left to right due to increasing atomic number and the corresponding increase in effective nuclear charge.

Among the elements mentioned in the options, chromium (Cr) has a higher melting point compared to manganese (Mn). It is because chromium has a larger atomic number and a higher effective nuclear charge. Which leads to stronger metallic bonding and higher melting temperatures.

Q56 Text Solution:

$$8\,MnO_4^- + 3\,S_2O_3^{2-} + H_2O \rightarrow 8\,MnO_2 + 6\,SO_4^{2-} + 2\,OH^-$$

From the reaction it is clear that, $a = 8$ and $y = 6$.

Q57 Text Solution:

Formula and name combination given in option (c) is incorrect. Its correct form is as follows.

$[CoCl_2(en)_2]Cl$ - Dichloridebis(ethylene diamine) - cobalt (III) chloride.

Q58 Text Solution:

	t_{2g}	e_g	Unpaired electrons
d^4 (low spin) –	↿⇂ 1 1		2
d^7 (high spin) –	↿⇂ ↿⇂ 1	1 1	3
d^9 (high spin) –	↿⇂ ↿⇂ ↿⇂	↿⇂ 1	1
d^6 (low spin) –	↿⇂ ↿⇂ ↿⇂		0

$\therefore d^7$ (high spin) system has maximum unpaired electrons.

Q59 Text Solution:

In general, the basicity of group 15 hydrides decreases on moving down the group from NH_3 to SbH_3. This is due to the increasing size of the central atom and the decreasing availability of lone pair for donation. Thus, the correct order of basicity of hydrides is $NH_3 > PH_3 > AsH_3 > SbH_3$

Q60 Text Solution:

Hypophosphorus acid (H_3PO_2) is a strong reducing agent which can effectively reduce Ag^+ ions to Ag and itself gets oxidise to phosphorus acid [H_3PO_3] as follows

$$3\,AgNO_3 + 4H_3\,PO_2 + H_2O \rightarrow 3Ag + 4H_3\,PO_3 + 3\,HNO_3$$